

Appl. № 10/754,800

Amdt. dated: October 7, 2005

Reply to Office action of July 13, 2005

## REMARKS/ARGUMENTS

### Amendments to the Specification:

The Specification, including the abstract of the disclosure, has been currently amended in accordance with the suggestion of the Expertise (Office action of 07/13/2005) to clearly specify the subject matter and correct some unfortunate misprints.

### Amendments to the Claims:

Claims 1-7 have been currently amended to correct editorial problems, regarding earlier requirements of examiner (Office action of 07/13/2005), though having kept the innovative sense of claims in accordance with the present invention.

Claim 8 is new. It reveals additional sufficient features from Specification, namely it clarifies the fundamentals of functional relationship amongst the echelons of the ultrasound intrusion detection system, the method of arranging of which is the subject matter of the present invention. Claim 8 has been added in compliance with the earlier requirement of examiner (Office action of 07/13/2005) regarding the necessity of clarifying the said novel relationship as far as the method itself and practical arranging of the same.

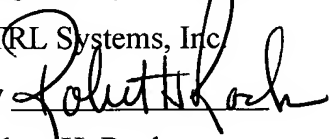
**Explanation** of the actual fact that the present invention by application #10/754,800 cannot be rejected under 35 U.S.C. 102(b) is delivered in the attached hereto **Appendix1**, which contains **Table 1a** at 3 pages, **Table 1b** at 5 pages, and **Table 2b** at 2 pages.

Applicant will gratefully meet a sequent examiner's requirement to amend insufficiently the Specification, i.e. to harmonize the wording with that of the current amendments to the Claims.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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## Method of Defense-in-Depth Ultrasound Intrusion Detection

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Int. Cl. .... **G01S 15/00**; G01N 29/00; ~~G08B 13/48~~.

U.S. Cl. .... **367/93**; 367/99; 73/628; ~~340/554~~.

Field of Search ..... 73/570, 584, 592, 625-628; **109/38, 40**;

**340/425, 426, 431, 505, 522, 539, 540, 541, 545.3, 552, 554, 568, 573, 683, 825.3, 988; 342/28; 348/163; 367/1, 5, 13, 87, 88, 93, 99.**

### References Cited

#### U.S. PATENT DOCUMENTS

4,582,065	4/1986	Adams .....	73/626
4,644,509	2/1987	Kiewit, et al. ....	367/87
4,677,852	7/1987	Pinyan .....	73/628
4,733,562	3/1988	Saugeon .....	73/626
4,949,074	8/1990	D'Ambrosia, et al. ....	340/552
5,231,608	7/1993	Matsui .....	367/93
5,483,224	1/1996	Rankin, et al. ....	340/539
5,761,155	6/1998	Eccardt, et al. ....	367/99
[5,872,516	2/1999	Bonge .....	340/573]
5,912,620	6/1999	Lin .....	340/554
5,920,521	7/1999	Kromer, et al. ....	367/93
5,930,199	7/1999	Wilk .....	367/88
6,256,263 B1	7/2001	Stevens .....	367/1
6,304,179 B1	10/2001	Lotito, et al. ....	340/545.3
[6,411,202 B1	6/2002	Gal, et al. ....	340/425.5]
6,430,988	8/2002	Watanabe .....	73/592
[2004/0140886 A1	7/2004	Cleveland .....	340/431]

## ABSTRACT

Method of ultrasound intrusion detection is disclosed wherein the ultrasound [surveillance in volumetric] multi-area [room] ~~volumetric surveillance~~ is being organized to meet ~~properly~~ the ~~correspondent~~ requirements [to faultlessness in providing] for the [preventive] defense-in-depth [intrusion] protection of critical objects. All the room around a protected object is being purposely arranged in juxtaposed volumetric [substantial] areas, which areas are closed or open and do represent respectively the central, short-range and long-range echelons of an entire defense-in-depth protection ~~space~~ [structure]. The pertain method of ultrasound detection of either ingress or ~~aggress~~ [egress] hazardous intrusion is being realized in each adjacent echelon regarding the specific task, which this very echelon has been commissioned with. These methods are being based ~~preferably~~ upon the [phenomena of] reflection, refraction [by edge diffraction] and interference [by shadowing] of narrowly directed ultrasound beams, ~~which~~ [The said] beams are being closely disposed in 2-D curvilinear [or polygonal] array [,] or [in] 3-D curved surface [lattice] ~~arrangement of~~ [onto multi-level solid openwork frames arranged in different echelons of a protected object.] ~~and~~ [These ultrasound beams are being] activated for target detection with use of ~~either~~ [unit] stationary vector directing [, stationary vector lattice arranging] or [unit/group vector scanning] ~~scan conversion~~ techniques. Processing ~~and displaying of self-checking~~, caution, [self-checking, intrusion vindication,] and alarm signals is being accomplished on the basis of logical programming [of the Goal Function for issuing alarm and security activating signals,] and with the same kind of hardware and software for each ~~method of~~ [the said] ultrasound detection [beams' response phenomena] involved ~~that~~ [The present invention] shall enhance the ~~reliability~~ [remote ability], trustworthiness and cost-effectiveness of the ultrasound detection of ingress or ~~aggress~~ [egress] intrusion throughout the adjacent volumetric [substantial] protection areas of critical objects.

[[7]] [8] Claims, 2 Drawing Sheets

### FIELD OF THE INVENTION

The invention relates to the acoustic wave methods and systems for presence or movement detection and for distance or direction finding in the case of having a plurality of ultrasound type transmitter and receiver transducers. In particular this invention refers to condition responsive early indicating systems that exploit the registration of an occasional disturbance of ultrasonic wave beams in the manner of their reflection, refraction [by edge diffraction] and interference [by shadowing, which disturbance has been made] created by either an intruding subject or a trespasser.

## BACKGROUND OF THE INVENTION

At the present there exist methods and systems of ultrasound intrusion detection in an entire volumetric surveillance areas, in which areas there are being used different arrangements of transmitting and receiving transducers, at least namely:

- fan-shaped or matrix arrangements of transmitter and receiver transducers for stationary vector directing surveillance, e.g. U.S. Patents #5,920,521 and #4,582,065 respectively;
- solitary arrangement of transmitter-receiver couples for scanning all over the surveyed area with narrow clusters of ultrasound beams, e.g. [US 2004/0140886 A1;] U.S. Patents #4,644,509; #5,309,144;
- multi-seat arrangement of receivers along the perimeter of protected area for detecting an occurrence of ingress or ~~aggress~~ [egress] intrusion thru the vicinity of protected area perimeter, e.g. U.S. ~~Patent~~ Patents #5,483,224 [and #5,872,516];
- single-row or multi-row arrangement of transmitting and receiving transducers for realizing various processing operations with the help of reflected ultrasound beams, in particular:
  - - detection any strange subject inside the surveyed area, e.g. Patents #5,761,155[, #6,411,202 B1] and #6,518,915B2;
  - - measurement of distance to intruded subjects or to the level of interface of liquid and granular materials, e.g. U.S. Patents #4,949,074, #5,231,608 and #5,131,271, #6,323,441B1 respectively;
- isolated arrangement of transmitter inside an enclosed area and positioning the receiver outside this enclosed area with the aim of detecting an occurrence of destroying the isolation of said protected area by an intruder, e.g. U.S. Patents #4,807,255, #5,638,048, #6,430,988.

As is evident from the delivered above the elucidative examples, the modern methods and systems for ultrasound intrusion detection utilize preferably the phenomenon of reflection of ultrasound beams from strange subjects that have occurred inside a surveyed area. Meanwhile, it is the known fact that the process of emitting-reception of airborne ultrasound signals depends strongly upon air ambient conditions (temperature, moisture, atmospheric pressure, etc.) and therefore it is restricted spatially. In turn, this restriction predicts the limitations upon volumetric dimensions of surveyed area and consequently on the capability of earlier warning detection of either an intruding object or a trespasser. The alternative enhancement of the entire protected space might be realized by attaching to the

ultrasound-surveyed area the proper number of adjacent areas, which areas were being surveyed with use of different [physical] principles of intrusion detection (infrared, microwave, light level sensing, etc.), e.g. see U.S. Patents #4,857,912 and #6,127,926. Unfortunately, such a would-be method and arrangement will lead to hardware and software complexity, low reliability and great cost of an intrusion protection system as a whole. Nevertheless, it is necessary to establish such very method of intrusion protection that features with high reliability and self-security, and meets the ~~proper~~ requirements to [the multi-echelon arrangement of] the protection systems of critical objects. Those ~~crucial~~ [strong] requirements are delivered at least in the following regulations for such evidently critical objects as Nuclear Power Plants:

- Defense-in-Depth in Nuclear Safety, IAEA INSAG-10, IAEA, Vienna, 1996.
- Method for Performing Diversity and Defense-in-Depth Analysis of Reactor Protection Systems. NUREG for U.S.NRC/Prepared by G.G. Preckshot-Lawrence Livermore National Laboratory/Manuscript date: December 1994.

Furthermore, it seems to be relevant to emphasize some unique features of ultrasound that make it attractive for the purpose of [faultless] intrusion protection [of a near field zone], namely:

- ultrasound waves are being emitted in the form of narrow directional ~~beam~~ [beams] and consequently do not travel around corners well, so [beam patterns of the] said directional ~~beam~~ [beams] may be easily reflected ~~and~~ or shielded by an intruded subject; [or they may be refracted, i.e. diffracted by the edge of an object having penetrated them into small part of their peripheral lobes;]
- narrow ~~spatial~~ [solid] angle [of] directional reception of airborne ultrasound may be obtained with relatively small dimensions of hidden receivers;
- ultrasound is not influenced by regular “white noise” of an environment, especially by an industrial ambient, being either inside or outside.

Besides, at the present time the ultrasound processing methods and instruments are being well practiced in even multi-modular hierarchical [imaging,] detecting [and measuring] systems that contain the similar ultrasonic instrumentation and hence are reliable, convenient and low-cost. This [real] ~~processing advancement~~ [advancement of the processing architecture] is the actual prerequisite for improving ~~an intrusion protection with use of~~ ultrasound [intrusion protection] technology [, which the present invention is devoted to].

## SUMMARY OF THE INVENTION

With the aim of ~~proper introducing~~ [introduction] into the [sense and] art ~~the mentioned above relevant specificity~~ of [the novel] ultrasound [intrusion detection] technology [provided by the present invention], it is necessary to identify the new basic objects of concern [, as it is set forth below].

The principle object of the present invention is to establish a method of anticipatory ultrasound intrusion detection that enables the purposeful application of all the advantageous features of ultrasound technology for ~~arranging the reliable early and~~ [sufficient enhancement of remote ability of] preventive defense-in-depth ingress or ~~aggress~~ [egress] intrusion detection ~~process in the limits of~~ [throughout the] multi-echelon dome-type volumetric space [near field zone and circumjacent vicinity] around a surveyed critical ~~installation~~ [object].

Other object of the invention is to arrange the whole protected dome-type volumetric room around a critical ~~installation~~ [object] in several juxtaposed areas, ~~which areas represent various echelons of the entire defense in depth intrusion detection volumetric space~~ [hence to create the multi-echelon structure in the form of multi-level solid openwork frame, outlined over the near field zone of a protected object regarding the remote ability of propagation of airborne ultrasound waves along their incidence and reflection trip at the forecasted atmospheric conditions of the air ambient].

Further object of the invention is to [determine] ~~choose properly~~ the geometrical shapes and dimensions of ~~these~~ 2-D [polygonal or] curvilinear [areas,] or 3-D curved ~~surface~~ surfaces ~~areas~~ [of those echelons] in correspondence with the spatio-temporal parameters of air-borne ultrasound propagation and the available capabilities [of selected ultrasound beam patterns] to cover all the said 2-D ~~curvilinear~~ [areas] or 3-D ~~curved~~ surfaces with stationary or scanning [said] ultrasound beam patterns ~~the relevant~~. [In turn, the selection of suitable beam patterns' characteristics (i.e. frequency range of a chosen transducer, effective transmitting-receiving distance of signals, solid angle of ultrasound beam pattern, rate of ultrasound attenuation, etc.) should be done with respect to the statistically forecasted conditions of ultrasound beam patterns' propagation in the air ambient, e.g. the annual average of temperature, humidity, atmospheric pressure, deflecting wind flows, etc.).]

Another object of the invention is to compose a graphic-analytical model of intrusion vulnerability for each [individual] echelon, taking to consideration [the real layout of protected object and] the ~~options~~ [optional models] of spatio-temporal ~~purposeful~~ behavior of intruder or trespasser [on their assumed routing, and the chosen mode of response of the emitted ultrasound signals (i.e. reflection, refraction by edge diffraction and interference by shadowing)].

The other object of the invention is to choose and assign for each echelon the ~~appropriate~~ [pertain] method of ultrasound intrusion detection regarding the ~~type~~ said [mode] of ultrasonic beam responding, i.e. ~~reflection, refraction and interference~~ [which should match the] ~~created by~~ predetermined behavior of either an intruding subject or a trespasser [on their presumptive routings].

The further object of the invention is to compose the generalized graphic-analytical model of intrusion vulnerability for [the] entire protected dome-type volumetric [multi-echelon structure that is being outlined in the form of multi-level solid openwork frame over near the field zone and circumjacent vicinity] ~~space~~ around a critical ~~installation~~ object. This [generalized] model must ~~properly establish an operatively reliable and functionally~~ [the logically] correct interrelation amongst ~~different adjacent~~ [juxtaposed and even non-adjacent] echelons [that is destined to intrusion justification, issuing alarm signals, and activating the protective and defensive measures. This interrelation is] based on the principle of early and preventive ultrasound detection of ingress or ~~aggress~~ [egress] intrusion [, where the said principle consists in gradual generating of caution, self-checking, intrusion vindication, and alarm and security activating signals in the result of logic processing of signals acquired during continuous status scan of detectors in all the echelons].

Still further object of the invention is to minimize the diversity of hardware and software [that should be utilized for] ~~of all [different ultrasound beams' response modes] techniques of ultrasound intrusion detection~~ involved, and to compose finally the mutual set of instruments and ~~logic~~ software [algorithm] for [the] entire defense-in-depth [ultrasound] intrusion detection [and justification] procedure. [It is evident that minimized architecture of hardware should be based on the conjugation of specification figures of various ultrasound instruments, at least operating frequency and bandwidth of ultrasound emission, S/N ratio, type of signal processing domain, that are destined for practicing different beam pattern's response modes, i.e. reflection, refraction by edge diffraction, and interference by shadowing the emitted beam pattern with a target. The software apparently should represent an algorithm in the form of information and processing logic matrix, which is being compiled on the basis of the Event Tree of intrusion modeling. This software algorithm should interpret mathematically the Goal Function of issuing the signals of intrusion detection, justification and prevention in the result of logical processing of caution and self-checking signals, acquired during continuous status scan of ultrasound detectors in all the echelons of the intrusion protection volumetric room.]

The specific content of the invention, as well as other objects and advantages thereof, will clearly appear from the following description and accompanying figures.

## BRIEF DESCRIPTION OF THE FIGURES

Preferred embodiments of the present invention will now be described with reference to the figures by way of illustration, in which the fundamentals of the suggested novel method of ultrasound multi-echelon intrusion detection are represented, in which like reference characters indicate like elements of method's arrangement, in which explanations of said arrangement are given, and in which:

**FIG.1** shows schematically an alternative embodiment of a defense-in-depth ultrasound multi-echelon intrusion detection ~~space~~ [spatial] structure ~~that, accordingly~~ [in the form of multi-level solid openwork frame, outlined over the near field zone and circumjacent vicinity of a protected object, which structure provides for the enhanced remote ability of propagation of the airborne ultrasound waves. Accordingly] to the present invention, [this structure] has been arranged in possession of juxtaposed ~~the in-built~~ [the central], short-range and long-range areas. These areas ~~principally~~ represent the corresponding echelons of said ingress or ~~aggress~~ [egress] ultrasound intrusion detection [volumetric room] with various ~~types~~ modes of ultrasound ~~beam~~ [beams'] response [involved]. As shown at **FIG.1**, the ~~in-built~~ [central] echelon **C** is being arranged inside the [premises of the] enclosed housing of a protected critical ~~installation~~ [object] 1. In this ~~in-built~~ [closed] echelon there is being used the ultrasound intrusion detection by the stationary vector directing or space scanning ~~scan~~ ~~conversion~~ techniques with reflecting and refracting [by] edge diffraction response of ultrasound beams. The transmitter-receiver sets are being mounted inside the premises of this ~~installation~~ [object] 1. According to the present invention, in the alternate embodiment of the method thereof, transmitters may be mounted inside [each of the] premises of the ~~installation~~ [object] 1 [,] but receivers correspondingly are mounted outside these premises for detecting any ~~breaking~~ [breakage] of their enclosures ([broken walls,] ~~opening~~ [opened] doors, windows, etc.). That case the receivers may be mounted at the peripheral outline of echelon **C**, where the adjacent echelon **S** begins.

The short-range echelon **S** is being shaped in the form of the 2-D [polygonal or] curvilinear [areas,] or 3-D curved surface ~~area~~ [areas] at the ~~direct~~ [adjoining] vicinity of external peripheral outline ~~of~~ [over] the [buildings with said] enclosed ~~housing~~ [premises and over the other outdoor installations] of [a] protected critical ~~installation~~ object, ~~which respectively~~ [.]. Respectively [the inner] outline [of echelon **S**] is ~~either~~ the [substantial] ~~plane~~ [planar] or volumetric [solid openwork frame]. In the short-range echelon **S** there is being used the ultrasound intrusion detection by the stationary vector directing [or space scanning] technique with refracting [by edge diffraction] or interference [by shadowing] response of ultrasound beams in the result of [respectively] intersecting or shielding of these beams by an intruding subject [or a trespasser]. ~~The at~~

[At] least one long-range echelon **L** is being arranged [outwardly and] adjacently [to] ~~outside~~ the outer peripheral outline of the short-range echelon **S**. In the long-range echelon **L** there is being used the ultrasound intrusion detection by preferably the stationary vector directing technique with [an occasional] reflecting response of ultrasound beams from the surface of an intruded subject.

**FIG.2** represents the logical interrelation of ultrasound detection signals [,] acquired from different juxtaposed [and non-adjacent] echelons **C**, **S** and **L**. [Since this logic of signals is being used for intrusion justification, the] ~~The~~ self-checking signals are being foreseen for every echelon that enables to analyze ~~the spatio-temporal behavior of intruder and the current operational state~~ [operating status] of each ~~surveying~~ echelon. [The simultaneous appearance of caution and positive self-checking signals should vindicate that an intrusion has occurred in the checked echelon.]

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferable embodiments of the present invention are being unveiled by the description of the ~~logical interrelation~~ [innovative approach to the use] of various ultrasound detection techniques [and their logic interrelation] that ~~have been purposefully involved into~~ [constitute the basic content of] the novel Method of Defense-in-Depth Ultrasound Intrusion Detection. The following detailed description is expected to deliver the appropriate explanation to advantages of these techniques and their beneficial interaction in ultrasound early and anticipatory intrusion detection procedure.

~~Let it be assumed that there exists~~ [At least one of the vital secure needs of] a critical object [(e.g. Nuclear Power Plant, refinery, offshore rig, flowing plant of gas-main pipeline, moored ship, plane station, helipad, etc.)) ~~installation, which needs~~ [is that of the] reliable and stealthy intrusion protection [system], see **FIG.1**. The protection reliability is to be enabled by use of early and preventive detection of an intruder or trespasser. The secrecy, in turn, may be realized thereto by utilizing ultrasound technology for detecting the presence or motion of objects, because it is difficult to notice or suppress ultrasound waves in air without special detectors and suppressing generators respectively. The presence or motion of suspected object within a surveyed area should result in reflecting, refracting [by edge diffraction] or interference [by shadowing] of [the] airborne narrowly directed ultrasound beams. Keeping in mind that ultrasound attenuates in air quickly enough, it seams ~~be~~ reasonable to arrange the whole protected room around a critical ~~installation~~ object in several juxtaposed inside and /or outside areas. [These] ~~which~~ areas represent consequently adjacent echelons of the entire defense-in-depth intrusion protection dome-shaped volumetric [multi-echelon structure in the form of multi-level solid openwork frame, outlined over the near field zone and circumjacent vicinity of a protected object]

space. The number of echelons, and their [shape and] space dimensions depend upon [the real layout of a protected object,] the amount of whole protected volumetric room, the known [available] spatial-temporal parameters of [the] airborne ultrasound propagation [in forecasted conditions of the air ambient,] and the predetermined behavior of an intruder or trespasser [on their assumed routings].

The said [expected] behavior predestines correct ~~those~~ [selection] of relevant ultrasonic detecting technique and instrumentation for each surveyed echelon. Consequently, [In compliance with the present invention] the said [system of the ultrasound] defense-in-depth protection of the entire surveyed room [must be] ~~is being realized with an appropriate~~ [organized] informational [in data] interaction [format that includes] ~~in logically exhaust signal~~ [logical] processing [of acquired signals] according to the following signal justification ~~sequence~~ [procedures]:

- simultaneous location inside all the echelons with forming the ~~warning~~ [caution] signals in case of presence or motion of suspected ~~objects~~ [subjects at least in one of the said echelons];
- keeping under surveillance the motion of suspected ~~objects~~ [subjects] throughout the [juxtaposed and non-]adjacent echelons with forming the *intrusion vindicating signals* if this motion is defined as an intrusion that threatens the protected critical ~~installation~~ [object];
- forming *self-checking signals* for verification of an intrusion occurrence and current check of performance reliability [of every echelon];
- logically processing the ~~warning~~ [caution] signals and *intrusion vindicating signals*[,] and releasing the *alarm signal* as well as [the] necessary ~~operation signals~~ [security activating] signals [in accordance with the designed *Goal Function*] of [the] protection procedure.

As it is shown at **FIG.1**, the whole room around a critical object is being arranged at least in three juxtaposed areas that are defined as [central] ~~in-built~~ (C), short-range (S) and long-range (L) echelons. The ~~in-built~~ [central] echelon C is being arranged inside the normally enclosed [at least one] premise of a [with the] protected installation [of a critical] object 1 that optionally is placed on a supporting base 2 [acting as a passive protection structure of said object from beneath]. The inside reflecting surfaces 3 are being constructed to enclose normally said protected installation [of object] 1. At least one pair of transmitter 4 and receiver 5 is being mounted inside the enclosed area of echelon C. Over the echelon C there is being arranged the internal border 6 of the short-range echelon S. The external border 7 of echelon S is being made to coincide with the frontier 8 of [the] open to outside the echelon L. In dependence on [the real layout of a protected object 1 and hence on the physical] volumetric shapes of surveyed echelons C, S, and L the said borders 6 and 7, and frontier [8] are being configured like either 2-D [polygonal or] curvilinear[,] ~~array~~ or 3-D curved spatial surfaces [of a solid

openwork frame], or [in] any combination thereof. The internal border 6 and external border 7 of the short-range echelon S both are being equipped with alternate pairs of [the mounted opposite each other] transmitters 9 and receivers 10, so that all of the area of echelon S is filled [in] with ultrasound ~~pattern beams~~ [beam patterns] 11, which ~~beams~~ [beam patterns] are arranged closely and directed ~~oppositely~~ opposite each other. [If the dimension of echelon S in prevailing direction of ultrasound location is bigger than the admitted value of the airborne ultrasound wave attenuation along its one-way emission trip from a transmitter to the opposite receiver, the said echelon should be divided into several sub-levels. The dimension of each of said sub-levels in said prevailing direction of location must provide for such admissible value of ultrasound attenuation in the forecasted conditions of the air ambient where the received signal is not less than the dead band of the ultrasonic receiver chosen for the said conditions of the air ambient.] The outer surface [of solid openwork frame] of frontier 8 of echelon L is equipped (~~preferably chequerwise~~) with integrated transmitter-receiver transducers, [i.e. transceivers] 12 [, disposed in the form of preferably chequerwise lattice], so that a sort of umbrella barrage of emitted upstream ultrasound is being formed by closely adjacent beam patterns 13 [where some of the transceivers 12 may be directed stationary, while another are being pivoted for scanning].

The principal operational character of each echelon is based upon the chosen ultrasound detecting technique[, which technique features distinctive mode of emitting of ultrasound signal and registration of its occasional disturbance regarding the expected mode of ultrasonic beam's responding]. Since the [central] echelon C ~~is a~~ [represents at least one] normally enclosed premise, it is reasonable to use therein the technique of ultrasound echolocation. The narrow ultrasound beam 14 is being emitted inward the enclosed area of echelon C and consequently reflected from inner surfaces 3 in the form of ~~a pattern lobe~~ of returned beam 15, provided these beams should not be disturbed by the presence of an intruder. Otherwise, said ~~pattern lobe~~ of returned beam 15 will be changed and receiver 5 consequently will register an intrusion. If the integrity of enclosure ~~of installation 1~~ ~~was~~ [were] destroyed, see dashed lines at FIG.1 (broken walls, opened doors or hatches, etc.),[.] the emitted beam 14 or some of the reflected beams 15 should go outward in the form of released beam 16 that might be registered by one of the receivers 10 of echelon S [[, so in]] [.] [In] the result [.] an ingress or ~~aggress~~ [egress] intrusion should be registered ~~as well~~. Thus ~~and so~~, inside echelon C there is being realized the couple of ultrasound techniques, namely[: the ultrasound echolocation inside the enclosed premises with use of reflection of ultrasound beams;] and detecting of [accidentally] outward released [the] airborne ultrasound by [direct receiving its beams with receivers 10. The arrangement of the said receivers 10 is being preliminary designed so that their beam patterns could overlap the areas of openings and

expected damages of the enclosure 1.] ~~scan mode, which techniques are being designated for the local detection of ingress or egress intrusion.~~ So far as echelon S is being designed for ~~perimeter~~ protection of [proximate] outside area [of near field zone] around the ~~installation~~ [object] 1, it appeared to be reasonable to use the technique of ultrasound beam interference because an expected intruder has to cross this echelon ~~in any case on~~ [along] his ingress or ~~egress~~ [egress] motion ~~regarding the critical installation 1.~~ It means that [In this case] an intruded target 17 ~~must~~ [should] interfere or ~~overshadow~~ [shadow] the ultrasound beams 11 going from transmitters 9 to receivers 10 ~~inside~~ [throughout the 2-D polygonal or curvilinear areas, or 3-D curved spatial surface zones of] echelon S. [Optionally, the interference of an intruded target with the surveying beam patterns of echelon S may lead to refraction of said beam patterns by the edge diffraction phenomenon. It means that the refracted, i.e. edge diffracted ultrasound beam pattern should register the event of penetration of an intruding object into the small part of its peripheral lobes. This small part of in-lobe penetration is less than the wavelength of ultrasound emission, which is approximately of 0.3445" or 0.875 cm. for airborne ultrasound emission at frequency of  $\approx 40$  kHz in normal ambient air conditions. So that, this mode of beam pattern response should provide for fast and correct detection of an intruder that tries to cross the frontiers and inside area of echelon S.] At the ~~perimeter~~ echelon S there may be utilized the target detection with use of ~~either~~ [unit] stationary vector directing[, stationary vector lattice arranging] or [unit/group vector scanning] ~~scan-conversion~~ techniques where ~~purposely~~ selected number of receivers 10 operate in the scan mode but the rest number of receivers 10 and all the transmitters 9 operate in stationary vector directing mode. [The purpose of activating the selected group of receivers 10 for in-phase scanning is the vindication of intruder's presence inside echelon S and defining vector of its motion that represents the direction and speed thereof. Since in the alternative arrangement of the present invention echelon S may be divided into several adjacent sub-echelons  $S_1, S_2, S_3, \dots S_{n+1}$ , where dimensions of each echelon are limited by the distance of feasible propagation of airborne ultrasound waves in the forecasted conditions of ambient air, the remotability of ultrasound detection inside echelon S should be sufficiently enhanced.]

The external echelon L is being designed for protection of ~~all the~~ [circumjacent dome-type air] vicinity [of the layout] area [of] the critical ~~installation~~ [object] 1 with the aim of early and anticipatory intrusion detection where an intruded target 18 must be found at its trajectory 19 of approaching this protected ~~installation~~ object. Since ultrasound beams 13 of echelon L are being emitted continuously outward the frontier 8 [,] and therefore [they] may return only when being reflected from a random target in the form of reflected beams 20, it appeared to be reasonable to apply the ~~technique of~~

ultrasound beam reflection with use of either stationary vector directing[, stationary vector lattice arranging] or [unit/group vector scanning] ~~scan-conversion~~ techniques where the selected number of transmitter-receiver transducers **12** may operate in stationary vector directing mode and the rest number of said transducers may operate in the volumetric scan mode. [The solid openwork frames of echelons **S** and **L** may be designed for 2-D polygonal or curvilinear, or 3-D curved surface array arrangement of pairs of transducers **9** and receivers **10** (echelon **S**), and of transmitter-receiver transducers **12** (echelon **L**) in dependence on the layout and enveloping space shape of the protected buildings and outdoor installation of the object **1**.] The purposeful choice of one of said techniques [of ultrasound emitting-receiving] and said arrangement of transmitter-receiver transducers **12** are being done in dependence of on the preliminary assumed graphic-analytical model of intrusion vulnerability of the long-range echelon **L**. Since the behavior of target **18** inside echelon **L** is really crucial for all the consequent intrusion protection activity, there is being organized the estimation of the main parameters of said behavior. For example, analyzing [the analysis of] the changes of dimension **H** [and speed of an approaching subject] in time and value may assess [run the assessment of] the threatening approach of target **18** to the installation [a protected object] **1** [or may indicate the invulnerable passing by of the said subject]. Optionally, Doppler detection may be used for signal processing [inside area] of the long-range echelon **L**.

This [The logic] matrix[, shown at **FIG.2**,] enables to analyze [organize the systematized programmable analysis of] the directional sequence of retrieved signals and to assess respectively direction, intensity and at least the real security threat of intrusion to the ~~protected installation~~ [buildings, works and installations of a protected object] **1**. This very analysis and assessment is being accomplished with respect to the preliminary composed the local [graphic-analytical models of predictive vulnerability for each of the echelons] and the generalized ~~the graphic-analytical models~~ [model] of [the presumptive] intrusion vulnerability [for all the multi-echelon protective structure]. The [Each of the local] graphic-analytical ~~model~~ models is being composed in accordance with the [real layout of the protected echelon and] forecasted [spatio-temporal] behavior of [an] intruder[,] and [with] the utilized ultrasound detecting technique ~~as it was described here before~~ [of emitting-responding, chosen] for each echelon **C**, **S** and **L** [regarding the task that each of those echelons has been commissioned with]. The generalized graphic-analytical model is being compiled with taking to consideration the specificity of each local model and the appropriate [software-programmable] informational [and processing logic] interaction among adjacent [juxtaposed and non-adjacent] echelons, [see **FIG.2**, that illustrates the inter-echelon tracing of an intruding subject or a trespasser].

in logical signal processing. In another words [So that], the generalized graphic-analytical model is being built on the basis of [used for prediction of the] variable vector of the [assumed] intruder's [threatening] motion throughout the echelons and on [for programming] the logically motivated [sequential] sequence [issuing] of warning [the caution, self-checking,] intrusion vindicating and alarm-activating signals[, and final signals of alarm and activating the passive and active measures of protection and defense]. [Thus, the said generalized graphic-analytical model represents the mathematical basis for plotting the cause-effect Event Tree of an intrusion occurrence and for sequent setting the matrix equations that are being solved for Goal Function of intrusion protection that provides for making the logically true decision on issuing the signals of intrusion detection, justification and prevention.] The table of FIG.2 shows also the versions of self-checking results in each echelon. This functional feature of signal processing is being foreseen for enhancing the reliability of signal processing procedure itself

According to the present invention the signal processing in echelon [among either juxtaposed or non-adjacent echelons] L, S and C, [i.e. the analysis and justification of said signals] is being carried out on the basis of logically exhaustive signal procedure [applied to the signals, which have been being acquired by continuous status scan of the ultrasonic receivers of all the echelons C, S and L]. The logic matrix for analysis of sequence and combination and sequence of [said registered] retrieved signals[, including the versions of self-checking results in each echelon,] is shown at FIG.2. [All the ultrasound responding signals are being registered in real time domain regardless the chosen mode of the said ultrasound signals' response. The said logic signals, see FIG.2, is the initial matrix for working out the software algorithm that should be compiled in the form of programmable logic for solving the matrix equations for the Goal Function with use of conditional logic proposition "If ..., then ..." i.e. by applying the logical implication regarding the sequence of the events retrieved from the Event Tree. The said software algorithm provides for:

- the uninterrupted status scan of the ultrasonic receivers of all the echelons simultaneously that enables to detect the intrusion occurrence either in only one echelon, or in several juxtaposed or non-adjacent echelons at the same time where the self-checking signal are being acquired regularly from every echelon and iteratively from the intrusion-suspected echelons;
- the continuous comparison of the running status of each echelon and their ensemble with the data from plotted a priory the Event Tree where this Event Tree is being plotted as the representation, in graphic or table matrices, of the interrelation amongst juxtaposed or non-adjacent echelons that is based on the sequence of the cause-effect events of: registration of an intrusion occurrence, then

defining the vulnerability due to the presence and motion of an intruded subject or trespasser, then undertaking the prior scheduled measures of active and passive protection and defense;

- the designation for each of the echelons the said scheduled measures of active and passive protection and defense that include respectively at least: activating an alarm system, enclosing the physical barriers around the protected works and installations, entrapping a trespasser on its actual routing preferably inside echelon C, applying disabling tear gas, involving the guard troops, deploying inflatable airborne obstacles in echelons S and L or opening the defensive fire therein.]

The suggested by the present invention the novel method of defense-in-depth ultrasound intrusion detection enables to minimize the hardware instrumentation and to simplify the processing software, since it utilizes though different but the only ultrasound intrusion detection techniques in each echelon, [which techniques are based on the different modes of ultrasound signals' responses (i.e. reflection, refraction by edge diffraction and interference, e.g. by shadowing). The architectural minimization of ultrasound processing hardware is being additionally defined by the chosen modes of intrusion monitoring inside every echelon with stationary vectoring or continuous scanning of all the ultrasonic receivers, optional utilization of Doppler detection technique, and customized use of the automatic adjustment of emitting-receiving frequency regarding sudden changes in the ambient air conditions.

The aim of the innovative approach of the present invention is to enhance the remotability of ultrasound intrusion monitoring due to the multi-level arrangement of ultrasound surveying network of transducers-receivers that enables long-range ultrasound location in spite of its intensive attenuation in the ambient air.] It permits to meet the requirements of functional diversity and simultaneous operational reliability in various redundant trains of reliable defense-in-depth safety systems[.] [[, e.g.]]

[Therefore, the method and arrangement of effective and stealthy ultrasound intrusion detection according to the present invention are of the evident necessity] for protection [of] Nuclear Power Plants[, refineries, offshore rigs, flowing plants of gas-main pipeline,] and other civilian and military objects. ~~Therefore this method shall be useful and beneficial for critical intrusion protection systems.~~

[The present invention is not to be confined to the precise details herein shown and described, nevertheless changes and modifications may be made so far as such changes and modifications indicate no significant deviation from the sense and art of the claims attached hereto.]

**Method of Defense-in-Depth Ultrasound Intrusion Detection**

**CLAIMS**

What is claimed as new and desired being secured by Letter Patent of the United States is:

**Claim 1. (Currently amended)** Method of defense-in-depth ultrasound intrusion detection that ~~establishes the purposeful interrelation of various techniques of ultrasound intrusion detection with the aim to ensure an early and anticipatory defense in depth intrusion protection throughout a multi-echelon and dome-shaped volumetric space around a surveyed critical installation.~~ provides for sufficient enhancement of the remote ability of airborne ultrasound location of an intruder throughout a near field dome-type volumetric zone and circumjacent dome-type air vicinity of the layout area that both constitute the entire volumetric room that surrounds a protected object, including the steps of: arranging the said entire volumetric room into the physical, tightly adjacent and preferably geometrically closed areas that constitute the spatial multi-echelon openwork structure of the defense-in-depth automatic intrusion protection system; and commissioning each of said echelons with the particular task of intrusion detection wherein: the central echelon (C) containing the enclosed premises of a protected object is being commissioned to detect the intruder's presence and direction of ingress or egress motion; the short-range single-level or multi-sublevel echelon (S) of the near field zone adjoining the buildings, works and installations of a protected object is being assigned to detect the presence and locality of an intruder as far as the direction of its motion; the long-range echelon (L) of the circumjacent vicinity of the layout area of a protected object is being charged with detection of the intruder's presence, and speed and direction of its motion; and rating the size of each particular echelon in the prevailing direction of intrusion location to the dimension that should not exceed the distance at which the airborne ultrasound wave attenuates along its incidence and reflection trip to the value less than the dead band of the ultrasonic transceivers where said transceivers are being chosen regarding their operating frequency and prognosticated conditions of the ambient air; and applying different modes of response of the emitted ultrasound signal, at least the reflection, refraction by edge diffraction and interference with shadowing by an intruded target, in accordance with the task of intrusion detection and presumptive spatio-temporal conditions of intrusion location in every

echelon in particular; and further  
establishing the software-programmable informational and processing logic interrelation among all the  
juxtaposed and non-adjacent echelons wherein said interrelation is being performed by software  
algorithm, which realizes: the continuous status scan of all the ultrasonic transceivers and  
oppositely aligned pairs of transmitters-receivers in every echelon simultaneously; the transferring  
of the acquired data to the logic matrix of control software; the processing of the acquired data on  
the basis of the prior model of intrusion vulnerability of each echelon and the entire area of a  
protected object, and on the basis of simulated a priori the model of the presumptive spatio-  
temporal behavior of an intruding subject or a trespasser where the said models serve for  
preliminary plotting the Event Tree of the intrusion protection method; and the issuing the logically  
true sequence of the caution and self-checking signals for every intrusion-suspected echelon, signal  
of intrusion vindication for the really affected echelon, and final signals of alarm and activation of  
security measures where the issuing the said final signals is being fulfilled as a result of solving the  
matrix equations that reveal the Goal Function of the new method of ultrasound intrusion detection.

**Claim 2. (Currently amended)** Method as defined in Claim 1 wherein all the whole of protected  
dome-type volumetric room around a critical installation object is being arranged in several juxtaposed  
areas, which areas are being defined as interrelated single-level or multi-sublevel echelons of an entire  
defense-in-depth intrusion detection space [[.]];

where the indoor single-level or multi-sublevel echelon C is being arranged inside the enclosed  
premises of a protected object, in each of which at least one couple of transmitter-receiver is being  
mounted for inward location of an intruder by ultrasound beam responding in reflection or  
refraction by diffraction modes; and

where the outdoor single-level or multi-sublevel echelon S of the near field zone adjoining the  
buildings and installations of a protected object is being shaped to consist of 2-D polygonal or  
curvilinear plane contours, and/or 3-D curved surface areas that are connected into the spatial solid  
openwork frame that is being equipped with the pairs of oppositely directed transmitters and  
receivers so that all this near field zone has been covered by closely adjacent ultrasound beam  
patterns, which are being designated to respond either in the refraction mode characterized with  
diffraction of receiver's beam pattern by intruder's edge, or in the mode of interference featured  
shadowing a receiver's beam pattern by an intruding subject; and further

where the echelon L of circumjacent dome-type air vicinity of the layout area of a protected object is

being shaped into 3-D curved surface in the form of substantial spatial lattice equipped with outwardly directed transceivers that function by the technique of preferably constant vectoring and operate in the mode of continuous emission of ultrasound beams and occasional reception of said beams once having been reflected by a target.

**Claim 3. (Currently amended)** Method as defined in Claim 2, including the steps of: wherein  
shaping the inner boundaries of outdoor single-level or multi-sublevel echelon S of the near field zone in compliance with layout and overground contours of installations and works of a protected object, while shaping the outer frontiers of the said echelon in compliance with layout and outside contours of a headwork and buildings of a protected object; and  
dividing the outdoor echelon S of the near field zone into a few sublevels and designing the geometrical shapes and dimensions of said 2-D polygonal or curvilinear contours, or 3-D curved surface areas ~~are being put in correspondence to~~ accordance with: the spatio-temporal parameters of air-borne ultrasound propagation towards prevailing directions of ultrasonic location in forecasted conditions of the air ambient, admitting the airborne ultrasound wave attenuation along its one-way emission trip from a transmitter to the opposite receiver to have occurred to the value not less than the dead band of the ultrasonic transceivers [[,]]; the presumptive spatio-temporal behavior of an intruder or trespasser over the terrain of the said echelon of a protected object regarding their possible routings [[,]]; ~~as far as to the available capabilities of covering all the said surfaces with the appropriate stationary or scanning ultrasound beam patterns during surveillance~~ chosen regarding the said conditions of ultrasound propagation and applied either in stationary or scanning modes of surveillance[[,]]; and  
shaping the echelon L of circumjacent dome-type air vicinity of the layout area of a protected object so that it is being done open outwardly to the dome-type surveyed room but its inside geometrically closed frontier is being configured as the openwork spatial lattice, enveloping the external frontier of the outdoor echelon S of the near field zone, otherwise the said both frontiers are being constructed to coincide in part or in full.

**Claim 4. (Currently amended)** Method as defined in Claims 2 and 3 ~~wherein a proper,~~ including the steps of:  
working out the graphic-analytical model of intrusion vulnerability for each echelon ~~is being composed~~ with regard to the options of supposed spatio-temporal purposeful behavior of intruder or trespasser

[[,]] along their possible routings inside premises of the central echelon C, around buildings and works of short-range echelon S, in the reach of ultrasound location inside the space of the long-range echelon L, where the said options of their ingress or egress routings thru every echelon are being elaborated with taking to account the layout and architectural features of the protective barriers against an intrusion, and various assumed ways of the trespassers' accessibility to the critical works and installations therein; and

verifying which graphic-analytical model is being used for verifying geometrical shape and dimensions of every echelon of the said entire defense-in-depth intrusion detection space[[.]] with respect to its pertained graphic-analytical model of intrusion vulnerability where the said verification is being accomplished by comparison of spatio-temporal parameters of intruder's or trespasser's purposeful behavior with spatio-temporal parameters of ultrasound beams' propagation and signaling response in prevailing directions of location.

**Claim 5. (Currently amended)** Method as defined in Claims 1, 2 and 3 wherein the appropriate technique of ultrasound intrusion detection for each of said echelons that features the distinctive mode of emitting ultrasound signal and registration of its disturbances is being chosen ~~and assigned~~ ~~regarding the type of ultrasonic beam responding, i.e. reflection, refraction by diffraction and interference, which types of ultrasonic beam responding are being respectively selected in compliance with previously composed worked out~~ following the steps of:

selection of modes of ultrasonic beam responding regarding the task which particular echelon has been commissioned with and in compliance with previously worked out the graphic-analytical models of intrusion vulnerability for each surveyed echelon[[.]]; and

defining the layout chart for disposing ultrasound transceivers having been distributed inside premises of the echelon C and mounted along the circumference of the echelon L, and for arranging the oppositely aligned pairs of transmitters and receivers along either adverse sides of the integral contour of single-level echelon S or adverse sides of the joining contours of juxtaposed portions of multi-level echelon S where the said disposing and arranging are being schematized in the form of the straight-line or elbow-type rows, planar array or in the spatial lattice for each of the said echelons with respect to the said graphic-analytical models of intrusion vulnerability and with obeying the requirements to tightly covering at least possible routings of intruders or trespassers with ultrasound beam patterns operating in stationary or in scanning mode of location.

**Claim 6. (Currently amended)** Method as defined in Claims 1 and 4 wherein the generalized graphic-analytical model of intrusion vulnerability for the entire protected dome-type volumetric room around a critical installation object is being composed, ~~which model is being created with the aim to establish an operatively reliable and functionally correct signal processing interrelation amongst different adjacent echelons based on the principle of early and anticipatory ultrasound detection of ingress or aggress intrusion thereinto~~ [[.]] including the steps of:  
graphical matching of frontiers of juxtaposed echelons for elimination of dead spots of ultrasound detection and for minimizing the number of transceivers, transmitters and receivers to be used; and  
graphic-analytical estimation of inter-echelon dependable vulnerability at occurrence of one or a few intrusions in one of the echelons, or in some of them simultaneously; and  
designation of physical barriers for having used them as hindrances of reaching the critical installations and as entrapments along the presumed routings of an intruding subject or a trespasser where this designation is being fulfilled regarding simulated a priori the model of the presumptive spatio-temporal behavior of an intruding subject or a trespasser; and  
definition of the territorial contours and limits of operation time, violating of which with the non-authorized presence or movement of an intruded subject or a trespasser should be considered to be the actual hazardous intrusion; and further  
assigning the Goal Function of intrusion protection of a critical object as the issuing the signals of intrusion detection, justification and prevention with finalized issuing the signals of alarm and activating of passive and active security measures where issuing the said signals is being accomplished as a result of solving the matrix equations as the logically true decision of the software algorithm.

**Claim 7. (Currently amended).** Method as defined in Claims 1 and 6 wherein the diversity of hardware and software of all the techniques of ultrasound intrusion detection involved used in juxtaposed and non-adjacent echelons is being chosen in accordance with said different modes of response of ultrasound signals utilized; and  
where the said hardware and software is being minimized in assortment and power consumption with the aim of consequent assembling the mutual set of instruments and prepare the appropriate software for logically exhaustive the defense in depth intrusion detection signal processing. on the bases of the conjugation of specification figures of various ultrasound instruments involved, at least like operating frequency and bandwidth of ultrasound emission, S/N ratio, and type of signal

processing domain, which specification figures are destined for practicing different modes of response of ultrasound beam patterns, including reflection, refraction by edge diffraction, and interference with shadowing the emitted beam pattern by a target, which modes should be used in juxtaposed and non-adjacent echelons of intrusion protection room around a critical object; and where the architectural minimization of ultrasound processing hardware is being additionally defined by the chosen modes of intrusion monitoring inside every echelon with stationary vectoring or continuous scanning of all the ultrasonic receivers, the optional utilization of Doppler detection technique, and by customized application of the automatic emitting-receiving frequency adjustment in the event of sudden changes in the ambient air conditions; and further where the processing software is being worked out in the form of software algorithm on the basis of information and processing logic matrix, which interprets mathematically the Goal Function of issuing the signals of intrusion detection, justification and prevention in the result of logical processing of caution and self-checking signals, acquired during continuous status scan of ultrasound detectors in all the echelons of the intrusion protection system.

**Claim 8. (New)** Method as defined in Claims 1 that provides for technique of drawing up the software algorithm in the steps of:

plotting the Event Tree of intrusion protection method in the form of graphic or table matrices for the representation the interrelation amongst juxtaposed or non-adjacent echelons where the said interrelation is based on the sequence of the cause-effect events of registration of an intrusion occurrence then defining the vulnerability due to the presence and motion of an intruded subject or trespasser then undertaking the prior scheduled measures of active and passive protection and defense, and where the said Event Tree reveals the status of vulnerability of each of the echelons on the basis of the simulated a priori the model of the presumptive spatio-temporal behavior of an intruding subject or a trespasser therein and prior generalized graphic-analytical model of the consequent intrusion vulnerability of the entire room around a protected object; and establishing by the graphic-analytical representation of the said Event Tree the information and protective interrelated links among the juxtaposed echelons, having opposed the way of one or a few intruding subjects or trespassers, and among non-adjacent echelons should said intrusions occurred in the said several echelons simultaneously where the said links interpret the inter-echelon information and processing exchange with the following cause-effect signals: caution and self-checking signals issued at the initial intrusion detection; intrusion vindication signals that are being

created as the result of vulnerability status test of every echelon and comparison of the said acquired status data with the simulated a priori the models of the presumptive spatio-temporal behavior of an intruding subject or a trespasser; alarm signals and signals of activating measures of protection and defense that are being issued as the result of comparison of the retrieved from the said Event Tree the data of inter-echelon vulnerability status with the prior generalized graphic-analytical model of the consequent intrusion vulnerability of the entire room around a protected object; and further

composing the matrix equations of the said software algorithm in the form of the logic matrices of the information exchange and processing logic among all the juxtaposed and non-adjacent echelons that include the boundary conditions in the form at least the territorial restrictions and operation time limits for non-authorized presence or motion of an intruding subject or a trespasser; and

defining the technique of logically true solution of the said matrix equations for the Goal

Function, regarding issuing the alarm signal and signals of security activating measures, by practicing the conditional logic proposition “If..., then ...” as the logical implication applied for processing the sequence of the following events: occurrence of an intrusion, then forming the caution signal in the designed ultrasound response mode, then providing the self-checking signaling from each of the intrusion-suspected echelons, then releasing the intrusion vindication signal, then issuing the signals of alarm and undertaking the appropriate passive and active measures of protection and defense; and further

programming the control software for issuing the alarm signals with and sequent signals of triggering the active and passive measures of protection and defense, which measures include activating an alarm system; enclosing the physical barriers around the protected works and installations; entrapping a trespasser on its actual routing preferably inside echelon **C**, applying disabling tear gas; involving the guard troops for raiding throughout echelons **C** and **S**; deploying the inflatable aerial obstacles in echelons **S** and **L**, or opening the defensive fire therein.

# Appendix 1

Table 1a (E-Office Action #1, mailed 07/13/2005)  
Sufficient differences between the inventions by application #10/754,800 (filed 01/09/2004) and by US Patent #4,319,332 on Mar. 9, 1982

Basic Features of the Inventions	Features, claimed in US Patent #4,319,332	Features, claimed in Application #10/754,800	Conclusion on the differences thereof	Note
1	2	3	4	5
Approach to an intrusion detection.	Utilization of a near-tropospheric long-distance propagation of single integral or split electro-magnetic laser beam, emitted from the point source in any known pulse scanning technique.	Use of propagation of airborne ultrasound waves from array-type sources, spatially and stationary arranged in some adjacent echelons over a near field zone of intrusion protection system of a critical object.	The difference in both said approaches is based on the radical difference of technical abilities and signal processing of electro-magnetic emission vs. ultrasonic one.	High-frequency electro-magnetic waves do not attenuate so fast as high-frequency ultrasound waves do.
Manner of the space sampling.	Simulation of arrangement of virtual entities (point, line, area, surface) inside entire volumetric space of surveillance, being done at distances of laser beam's turnaround, i.e. of its double way run in ground-to-near-tropospheric area.	Arranging a few physical adjacent areas inside the dome-type surveillance room around a critical object, like a multi-echelon structure in the form of multi-level solid openwork frame, outlined over near field zone of possible propagation of airborne ultrasound waves, where the spatial area of each echelon is closely covered by the static or scanning ultrasound beam patterns.	Since the airborne ultrasound waves' propagation is limited due to their fast attenuation in air, the manner of the space sampling for ultrasound emission radically differs from one for laser electro-magnetic emission.	It's possible to enlarge the remotability of ultrasound detection in air, but only by dividing the monitored area into some adjacent levels, each dimensioned by possible distance of the ultrasound propagation.
Goal Function of intrusion detection and arrangement for implementation of the same.	Utilize the electromagnetic laser pulse-type emission, along with hybrid (pulse-time, pulse-phase and pulse-width) modulation, for surveillance all over the ground-to-near-tropospheric area that surrounds a critical object with the aim of <i>issuing the intrusion alarm signal that is essentially immune against intentional attempts to impair the function and operational integrity of the supervising equipment.</i> The said supervision is being fulfilled by the integral or split laser beams being emitted from the individual radiation source in the form of radiation pulses, and being received once having been reflected from an intruder.	Use the airborne, jam-resistant and stealthy ultrasound emission for surveillance around the near field dome-shaped area of a critical object with the aim of <i>faultless, early and preventive warning of intrusion, and reliably hindering the detected intruder's motion by timely issuing the alarm, and security activating signals.</i> The said surveillance is being fulfilled by groups of transceivers that are being disposed stationary in 2-D polygonal or curvilinear array or 3-D curved surface arrangement at the multi-level solid openwork frame and operate simultaneously in the manner of covering tightly the supervised areas of multi-echelon intrusion protection structure with stationary or scanning ultrasound beam patterns.	Since the ultrasound intrusion detection system features the near field monitoring area around a protected object, its Goal Function differs in such manner of signal processing that provides for early and preventive alarm of intrusion. The limited space surveillance capabilities of ultrasound waves results in arranging of the transceivers in the spatial array-type location over multi-level openwork structures that enables to cover the checked area with multiple ultrasound pattern beams, which are vectored stationary or act in continuous scanning.	The Goal Function of the ultrasound intrusion detection system differs in compulsory use of successive signals that warn of the upcoming threat, i.e. the signals of caution, self-checking, intrusion vindication, alarm, and security activating.

Appendix 1 (Continued) Table 1a (E-Office Action #1, mailed 07/13/2005)

1	2	3	4	5
Method of prior intrusion justification before issuing an alarm signal.	Comparison of preliminary recorded images (obtained during reflection of scanning or vectored laser beams from dummy targets) with images of suspected intruders, obtained by recording the reflected laser beam that scans all over the near-tropospheric space around a protected object.	Verification of caution signals by: checking operational integrity of the array-embedded transceivers inside all the echelons, tracing the signals obtained in continuous status scan of all the receivers, and logic processing of ultrasound caution signals throughout all the echelons.	Method of prior intrusion justification before issuing an alarm signal, used in the present invention, distinctly features algorithm of logic processing in the form of inter-echelon information and processing logic matrix, which mathematically interprets the Goal Function of issuing the signals of intrusion detection, justification and prevention.	The flow chart of such an algorithm (presently not shown in the disclosure) should define the minimized architecture of the hardware for the arrangement of the intrusion detection system in accordance with the present invention.
Types of emitted waves and response modes of their operation.	The <b>electro-magnetic waves</b> are being emitted by the pulse-like laser radiation technique from the one-post transceiver unit source. The emitted measuring laser beam operates only in the mode of reflection phenomenon.	Piezo-electric transducers, arranged in 2-D or 3-D arrays over portions of multi-level solid openwork frame, emit <b>ultrasound waves</b> . Ultrasound beam patterns created in adjacent substantial echelons operate in the modes of reflection, refraction by edge diffraction, and interference with shadowing by a target.	The difference between types of emitted waves is evident. The laser location predicts its operation only in the reflecting mode, while the ultrasound location permits operation modes of reflection, refraction by diffraction & interference.	Arranging of several adjacent levels of ultrasound emission and signal processing interrelation among them increases the distance and reliability of ultrasound location.
Types and arrangement, and operational manner of beams' emission sources.	Arranged in <i>only one-post embodiment</i> , the <b>individual source</b> of electro-magnetic radiation is utilized for emission of laser beam. The said integral or split beam is being vectored in polar coordinates sequentially onto one or another virtual portion (point, line, area, or limited space) of surveyed hemisphere near-tropospheric space around a protected object.	Arranged in <i>spatial, array-type multi-level openwork frame</i> , the <b>group-type source</b> of ultrasound waves' radiation is to be used for emission of ultrasound beam patterns, which patterns simultaneously and closely cover all the areas of stationary substantial levels of the surveyed near field space and circumjacent dome-type air vicinity around a protected object.	There is apparent difference of said features in good account of ultrasound multi-echelon intrusion detection, since the continuous status scan of all the detectors of a group-type source simplifies the software, and improves faultlessness and trustworthiness of triggering an alarm signal.	One-post embodiment of individual source of laser electro-magnetic emission is extremely vulnerable to intended suppression, while the multi-level structure of ultrasound emission enhances the reliability and safety thereof.
Pertained Classes of the claimed inventions thereof.	U.S. Cl. <b>364/516</b> ; 340/556; 340/557; 343/5 <b>PD</b> ; 356/5. Int. Cl. <b>G01B 13/18</b> . <b>Note:</b> U.S. Cl. 340/ - Communications, Electrical: Condition responsive indicating system. U.S. Cl. 340/552 - Disturbance of electromagnetic waves. U.S. Cl. 340/555- Light; 340/556 - Beam. 340/557 - Laser.	U.S. Cl. <b>367/93</b> ; 367/99. Int. Cl. <b>G01S 15/00</b> . <b>Note:</b> U.S. Cl. 367 - Communications, Electrical: Acoustic wave systems and devices. U.S. Cl. 367/93 - Presence or movement only detection. U.S. Cl. 367/99 - Distance or direction finding.	Difference in classification of these inventions arises due to sufficient difference between: Physical origin of waves being emitted; Approaches to the technique of the intrusion detection, justification, and protection; and Manner of the space sampling.	The selection of U.S. Class and Int. Class of the present invention is substantiated in the section "FIELD OF THE INVENTION" of the disclosure on the basis of data from US patent classification.

**Appendix 1 (Continued) Table 1a (E-Office Action #1, mailed 07/13/2005)**

1	2	3	4	5
<p>Technique of intrusion detection.</p>	<p>The one-post transceiver unit operates continuously in polar coordinates for fulfilling the remote and sequential sampling inquiry of the virtual, and geometrically open, portions (point, line, area, or piece of space) of the surveyed hemispheric, tropospheric-range entire space around a protected object. The purpose of this operation is to transmit long-distance laser beams in the form of hybrid-type frequency modulated groups of radiation pulses in accordance with predetermined program, than to receive in groups the reflected energy of the transmitted radiation pulses, than to evaluate in groups the received reflected energy, than to detect change in the reflected energy and utilize this detected change of the received signal as criteria for tripping an alarm.</p>	<p>The entire volumetric room over protected object is divided into juxtaposed areas, each dimensioned to the feasible distances of ultrasound propagation in statistically forecasted conditions of the air ambient. Since each area is being outlined as the close contour, it forms a trap for an intruder. The ultrasound transceivers are being installed along outer 2-D or 3-D, closed geometrically, frontiers of those areas, which represent the adjacent echelons of the entire multi-level intrusion detection volumetric openwork frame-type structure that is arranged over the near field zone around a protected object. Occurrence and vindication of presence or movement of an intruder is being done during continuous status scan over all its receivers. The inter-echelon interrelation in processing logic results in issuing the trustworthy alarm and security activating signals.</p>	<p>The suggested novel method of defense-in-depth ultrasound intrusion detection enables trustworthy of alarm signal, since, except evaluation of the received signals inside every echelon, it establishes self-checking procedure for every echelon and the algorithm of inter-echelon interrelation in processing logic of signals having been retrieved from juxtaposed echelons where those signals feature different modes of emitted ultrasound beams' response. Algorithm provides for conversion of the spatially distributed signals' tracing into the procedure of centralized issuing of Goal Function's alarm &amp; security activating signals.</p>	<p>Compared inventions differ evidently due to the different destinies:  * laser location of a target from one-point source is used for long distance scan of virtual geometrically open portions of space over protected object;  * ultrasound location by transceivers, spatially distributed over multi-level and frame-type openwork structure, is used for near field detection of intruder's ingress or egress thru adjacent echelons of defense-in-depth volumetric area of intrusion protection.</p>
<p>Criteria of operational software and architecture of hardware.</p>	<p>Criterion of operational software is the comparison of spatio-temporal sampled and read parameters of reflected laser beam's energy, namely: polar coordinates of vector and intensity of a single signal reflection; difference in those parameters for groups of reflected signals regarding the sample signals, stored during preliminary settings and records. The architecture of hardware is built with regards to procedures of at least:  * accumulation of data base for prior sampling of reflected signals; and  * computational comparison of stored and acquired signals, and issuing an alarm signal after iterative verification of read out signals.</p>	<p>Criterion of software for processing the read ultrasound signals is based on the methods and systems for presence or movement detection and for distance or direction finding in the case of having a plurality of ultrasound type transmitter and receiver transducers. The said software is designed with regards to conditions of early and preventive indication, which exploit the registration of disturbance of ultrasound beam patterns in the manner of reflection, refraction by edge diffraction, interference with shadowing, created by an intruder. Minimized architecture of signal processing hardware must realize algorithm in the form of information and processing logic matrix, which interprets mathematically the Goal Function of issuing the signals of intrusion detection, justification and prevention.</p>	<p>The principal distinction between said criteria arises evidently from different forms of acquired signals, and also from different ultimate signs and limits of intrusion for issuing an alarm signal, where:  * the ultimate signs for laser detection system are polar coordinates of feasible path;  * the crucial sign of danger for ultrasound detection system is the vindicated presence of an intruder in at least one of the adjacent echelons, which is done by informational and processing logic interaction amongst the said echelons.</p>	<p>Every echelon of this novel ultrasound intrusion protection system acts as the independent one for detection of presence or movement and for verification of the reality of intrusion. Interrelation among all the echelons is used for intrusion vindication and defining the vector parameters of intrusion development.</p>

# Appendix 1

Table 1b (E-Office Action #1, mailed 07/13/2005)

**Differences in wording between the inventions by application #10/754,800 (filed 01/09/2004) and by US Patent #4,319,332 on Mar. 9, 1982.**  
(See point #20 of Office Action Summary: Examiner Jennifer A. Stone; Art Unit #2636, mailed 07/13/2005)

Place of features cited and contraposed by Expertise	Original wording in US Patent#4,319,332	Wording in initial version of Claims of Application #10/754,800	Difference of inventions' basic features that is fixed by the difference in wording	Note
1	2	3	4	5
Fig. 1, Items 19-21; Col. 3, Ins 38-41 and 48-52; Col. 4, Ins 63-68.  <u>Note:</u> Col.4, Ins 40-51 and 60- 63 were submitted by Applicant as the opportune remarks.	Fig.1 and Col.4, Ins40-51: "FIG.1 illustrates region, hereinafter simply generally referred to as the terrain or surface 1, in plan view. The line 4 extending between the boundary lines 3 and 5 is to be understood as constituting a virtual line, which does not appear physically within the terrain 1, yet is defined or fixed as far as its course or extent is concerned by data stored in a storage or memory ... by the polar coordinates..."; "...the virtual line 4 can be determined, for instance, by linear interpolation by means of a computer or according to a predetermined function..."  Col.4, Ins 63-68: Thus for instance, the partial surface 19 may constitute a first warning zone, the partial surface 20 a second warning zone, and the partial surface 21 a protective zone. Each of the aforementioned partial surfaces 19, 20 and 21 therefore advantageously has allocated thereto a predetermined significance.	Claim 1: Method of defense-in-depth ultrasound intrusion detection that establishes the purposeful interrelation of various techniques of ultrasound intrusion detection with the aim to ensure an early and anticipatory defense-in-depth intrusion protection throughout a multi-echelon and dome-shaped volumetric space around a surveyed critical installation.	Though the purpose of the compared inventions is nearly similar, difference in the shown wording reveals their basic difference in at least the following (see Table 1a): * Approach to an intrusion detection. * Manner of the space sampling. * Types of emitted waves and response modes of their operation. * Types and arrangement, and operational manner of beams' emission sources. * Pertained Classes of the inventions, compared herein.	It's necessary to agree with Expertise on inevitability of amending as the Specification as the Claims of the invention by the application #10/754,800 [37CFR § 1.121 (b); (c)], with the aim of "... distinctly claiming the subject matter which the applicant regards as his invention" (Second paragraph of 35 U.S.C. 112).
Col.4, Ins60-63: "By means of these virtual lines 4, 17 and 18 the surface area is divided into partial surfaces 19, 20 and 21, each of which can have allocated thereto a certain meaning of significance."	Col. 3, Ins 38-41 and 48-52: That text evidences only of the purpose and scope of the invention by US Patent #4,319,332.			

Appendix 1 (Continued) Table 1b (E-Office Action #1, mailed 07/13/2005)

1	2	3	4	5
Fig.1; and Col.5, Ins41-48; Col.10, Ins 40-42.	<p><u>Col.5, Ins41-48. Actually it regards Fig.2 (Note of V.B.):</u> A space sector or region <b>22</b> extends outwardly from point <b>2</b>. Its angular limits are defined by fixing certain points in the region or space, for instance by points <b>23</b>, <b>24,25</b> and <b>26</b>. By means of these points <b>23</b>, <b>24,25</b> and <b>26</b> and possibly further points, for instance by points <b>27</b> and <b>28</b> and even further points, it is possible to define a randomly extending surface as a virtual surface <b>29</b> in the space or region <b>22</b>.</p> <p><u>Col.10, Ins 40-42:</u>According to a given field of application it can be advantageous for the purpose of as gapless covering as possible of a virtual surface with focal spots, that the focusing of the radiation is controlled as a function of the momentary direction.</p>	<p><u>Claim 2:</u> Method as defined in Claim 1 wherein the whole of protected dome-type volumetric room around a critical installation is being arranged in several juxtaposed areas, which areas are being defined as interrelated echelons of an entire defense-in-depth intrusion detection space.</p>	<p>The basic difference thereof is that US Patent #4,319,332 claims for computerized defining in polar coordinates the virtual surfaces inside angularly limited spatial sector region <b>22</b>, while the application #10/754,800 claims at least for such innovative and distinctive features as (see <b>Table 1a</b>):</p> <ul style="list-style-type: none"> <li>* Manner of space sampling in substantial adjacent areas.</li> <li>* Types of emitted waves and response modes of their operation.</li> <li>* Technique of intrusion detection.</li> </ul> <p>Besides, this difference is also in that the juxtaposed echelons are being in logic interaction but not bound functionally to one central point (See <b>Fig.2</b> of the application #10/754,800).</p>	<p>It's necessary to agree with Expertise on inevitability of amending the Specification and the Claims of invention by the application #10/754,800 [37CFR § 1.121 (b); (c)], with the aim of "... distinctly claiming the subject matter which the applicant regards as his invention" (Second paragraph of 35 U.S.C. 112).</p>

Appendix 1

(Continued) Table 1b (E-Office Action #1, mailed 07/13/2005)

1	2	3	4	5
<p>Fig. 2; Col.5, Ins 41-48 and 56, 57. Col.7, Ins 8-17 and 63-68. Col.8, Ins 1-4.</p>	<p>Col.5, Ins 41-48 and 56, 57: Col.5, Ins41-48 was shown before on page 2 of this <b>Table 1b</b>. Col.5, Ins56 and 57: The virtual surfaces 29 and 36 have each been illustrated in <b>FIG.2</b> by a line grid or network. Col.7, Ins 8-17 and 63-68. Col.8, Ins 1-4: If an object which has been detected by the measuring beams moves, then by mathematical processing of the measured values or results, i.e. the transit times, as such are represented by the distance vectors of the measuring beams, it is possible to determine not only information concerning the size and shape of configuration and position of the object, but also movement criteria of the object. Such movement criteria relate to the path of travel or trajectory of the object, its speed and acceleration. In analogous manner it is thus also possible with a spatial arrangement, as shown in <b>FIG. 2</b>, for the penetration of virtual surfaces 29 and 36 to represent the boundaries of warning and protective areas, and by mathematically evaluating a sequence of defined measuring beams to also determine the entry of one or a number of objects into such zones. Also the residence time of the measured objects in such zones or space can be determined by mathematical evaluation of the relevant measuring beams. “<b>FIG. 2</b> depicts a 3-D curved geometric surface area”. – This is wording of Expertise (Office Action # 1, mailed 07/13/2005).</p>	<p><u>Claim 3</u>: Method as defined in Claim 2 wherein the geometrical shapes and dimensions of said 2-D curvilinear or 3-D curved surface areas are being put in correspondence to the spatio-temporal parameters of air-borne ultrasound propagation, the presumptive spatio-temporal behavior of an intruder or trespasser, as far as to the available capabilities of covering all the said surfaces with the appropriate stationary or scanning ultrasound beam patterns during surveillance.</p>	<p>The basic difference thereof is that US Patent #4,319,332 claims for utilization of the virtual surfaces for sampling the surveyed volume inside the angularly limited spatial sector region 22, while the application #10/754,800 claims at least for such novel and distinctive features as (see <b>Table 1a</b>):</p> <ul style="list-style-type: none"> <li>* Manner of space sampling in substantial adjacent areas.</li> <li>* Types of emitted waves and response modes of their operation.</li> <li>* Technique of intrusion detection.</li> <li>* Criteria of operational software and architecture of hardware.</li> </ul> <p>There is also difference in math data processing, since the application #10/754,800 claims for use of software algorithm based on the inter-echelon information and processing logic matrix. Said application also claims for distributing of ultrasound beam patterns over physical areas vs. claims of US Patent #4,319,332 for focusing laser beams on a virtual areas.</p>	<p>It's necessary to agree with Expertise on inevitability of amending as the Specification as the Claims of invention by the application #10/754,800 [37CFR § 1.121 (b); (c)], with the aim of “... distinctly claiming the subject matter which the applicant regards as his invention” (Second paragraph of 35 U.S.C. 112).</p>

Appendix 1

(Continued) Table 1b (E-Office Action #1, mailed 07/13/2005)

1	2	3	4	5
<p>Col. 7, Ins 63-68; Col. 8, Ins 1-4 and 15-29; Fig. 2.</p>	<p>Col. 7, Ins 63-68 and Col. 8, Ins 1-4 were shown here before on page 3 of this Table 1b. Col. 8, Ins 15-29: By mathematical evaluation of such multiplicity of measuring beams and vectors resulting from the relevant object 40, it is possible with appropriate programming of the computer to not only compute criteria concerning object size, shape, configuration, but also as concerns the movement behavior, such as direction, velocity, acceleration, periodicity and so forth. By comparison of such criteria or data with stored data concerning size, shape, configuration, movement behavior, such as direction, velocity, acceleration, periodicity, and so forth of known object, it is possible, in the presence of at least approximate coincidence, to recognize the measured objects and to identify the same and, for instance, to allocate thereto a certain object classification and category.</p>	<p>Claim 4: Method as defined in Claims 2 and 3 wherein a proper graphic-analytical model of intrusion vulnerability for each echelon is being composed with regard to the options of supposed spatio-temporal purposeful behavior of intruder or trespasser, which graphic-analytical model is being used for verifying geometrical shape and dimensions of every echelon of said entire defense-in-depth intrusion detection space.</p>	<p>The basic difference thereof is that US Patent #4,319,332 claims for computational modeling of scan over the virtual surfaces for stored and running sampling the surveyed volume inside the angularly limited spatial sector region 22, while the application #10/754,800 claims at least for such innovative and distinctive features as (Table 1a): * Manner of space sampling in substantial adjacent areas. * Types of emitted waves and response modes of their operation. * Technique of intrusion detection. * Method of prior intrusion justification before issuing an alarm signal. * Criteria of operational software and architecture of hardware.</p>	<p>It's necessary to agree with Expertise on inevitability of amending as the Specification as the Claims of the invention by application #10/754,800 [37CFR § 1.121 (b); (c)], with the aim of "... distinctly claiming the subject matter which the applicant regards as his invention" (Second paragraph of 35 U.S.C. 112).</p>
<p>Col. 5, Ins 16-28: By means of each such transmitted beam pulse there is formed, in each case, a certain measuring beam which, as the case may be, is reflected at an object or by the terrain as the background. As a matter of convenience in this disclosure such measuring beam associated with a reflection will be designated as a direct measuring or measurement beam. On the other hand, if there does not occur any reflection, for instance because of complete or practically complete radiation absorption or because the transmitted beam or radiation is reflected or deflected away in another direction, then such measuring beam will be referred to hereinafter as indirect measuring or measurement beam.</p>	<p>Col. 5, Ins 16-28: By means of each such transmitted beam pulse there is formed, in each case, a certain measuring beam which, as the case may be, is reflected at an object or by the terrain as the background. As a matter of convenience in this disclosure such measuring beam associated with a reflection will be designated as a direct measuring or measurement beam. On the other hand, if there does not occur any reflection, for instance because of complete or practically complete radiation absorption or because the transmitted beam or radiation is reflected or deflected away in another direction, then such measuring beam will be referred to hereinafter as indirect measuring or measurement beam.</p>	<p>Claim 5: Method as defined in Claims 1, 2 and 3 wherein the appropriate technique of ultrasound intrusion detection for each of said echelons is being chosen and assigned regarding the type of ultrasonic beam responding, i.e. reflection, refraction and interference, which types of ultrasonic beam responding are being respectively selected in compliance with previously composed graphic-analytical models of intrusion vulnerability for each surveyed echelon.</p>	<p>One of the distinctive features of invention by application #10/754,800 consists in use of different modes of response of emitted ultrasound signal, namely: reflection, refraction by edge diffraction and interference with shadowing by a target. Every echelon is being commissioned with proper said mode of response according to its specific task of warning and protection. The unique software algorithm based on the information and processing logic matrix reveals the echelon's interaction for solving the Goal Function on issuing the alarm and security activating signals.</p>	<p>The same.</p>

# Appendix 1

(Continued) Table 1b (E-Office Action #1, mailed 07/13/2005)

1	2	3	4	5
Col.8, Ins 21-29; Col.21, Ins 57-61.	<p><u>Col.8, Ins 21-29:</u> By comparison of such criteria or data with stored data concerning size, shape, configuration, movement behavior, such as direction, velocity, acceleration, periodicity, and so forth of known object, it is possible, in the presence of at least approximate coincidence, to recognize the measured objects and to identify the same and, for instance, to allocate thereto a certain object classification and category.</p> <p><u>Col.21, Ins 57-61:</u> In <b>FIG.9</b> reference character <b>600</b> designates the beam dividing or splitting system in its entirety, which is provided when using the invention for monitoring discrete surfaces, for instance a door opening <b>601</b> and a window opening <b>602</b> of a building <b>603</b>.</p>	<p><u>Claim 6:</u> Method as defined in Claims 1 and 4 wherein the generalized graphic-analytical model of intrusion vulnerability for entire protected dome-type volumetric room around a critical installation is being composed, which model is being created with the aim to establish an operatively reliable and functionally correct signal-processing interrelation amongst different adjacent echelons based on the principle of early and anticipatory ultrasound detection of ingress or egress intrusion there into.</p>	<p>There was claimed in application #10.754,800 the novel approach to which (see <b>FIG.2</b>) consists in information and processing logic interaction among the juxtaposed and non-adjacent surveyed echelons on the basis of the generalized graphic-analytical model of the assumed vulnerability thereof. It provides for making a trap for an intruder inside every said physical echelon regardless any prior knowledge about an intruder. Thus, this approach evidently differs from claimed in US Patent #4,319,332 the technique of comparison of the virtually sampled and stored data with the running results of the laser location over the virtual portions of a space.</p>	<p>It's necessary to agree with Expertise on inevitability of amending as the Specification as the Claims of the application #10/754,800 [37CFR § 1.121 (b); (c)], for "... distinctly claiming the subject matter which the applicant regards as his invention" (Second paragraph of 35 U.S.C. 112).</p>
Col.2, Ins 59-64; Col.15, Ins 38-45; Fig. 6.	<p><u>Col.2, Ins 59-64:</u> A computer serving as an evaluating device mathematically evaluates a multiplicity of reflection signals, which have been received from different directions and/or reflection signals, which should have been reflected but have not appeared.</p> <p><u>Col.15, Ins 38-45; Fig. 6:</u> The satellite computer <b>300</b> comprises an input/output unit (I/O - port) <b>301</b>, furthermore a central processor unit (CPU) <b>302</b>, a programmable storage or memory (PROM) <b>303</b> and a write-read storage with random access (RAM) <b>304</b>. Here also, all of these components can be interconnected or brought into operable interconnection with one another in conventional manner by means of a second multiple-bus (BUS) <b>305</b>.</p>	<p><u>Claim 7:</u> Method as defined in Claims 1 and 6 wherein the diversity of hardware and software of all techniques of ultrasound intrusion detection involved is being minimized with the aim of consequent assembling the mutual set of instruments and prepare the appropriate software for logically exhaustive the defense-in-depth intrusion detection signal processing.</p>	<p>Claimed in the application #10.754,800 the procedure of mathematical evaluation features the use of processing logic for continuous estimation of status of every substantial echelon, and the intrusion protected area as a whole. This basic difference provides for application of any known simple arrangement of the off-the-shelf hardware for processing different types of ultrasound response signals (reflection, refraction by diffraction, and interference with shadowing by a target) in the harmonized real time and/or frequency domain for fixing ultrasound waves (see page 3 of Table 1a.)</p>	<p>The same.</p>

# Appendix 1

## Table 2b (E-OfficeAction#1, mailed 07/13/2005)

### Differences between basics of the invention by application #10/754,800 (filed 01/09/2004) and the inventions, contraposed by Expertise

(See point #22 of Office Action Summary: Examiner Jennifer A. Stone; Art Unit #2636, mailed 07/13/2005)

Number of the contraposed document	The essence of the document's disclosure revealed by Expertise with use of wording from the Application #10/754,800	The essence of the document's disclosure in its published wording	The distinctive features of the invention by Application #10/754,800	Note
1	2	3	4	5
Patent No. US 6,411,202 B1.	"...discloses an ultrasonic transmitter that measure geometry of objects and an interior space for object detection."	<u>Col.2, Ins 11-18 and 46-48</u> : "There is thus provided ... a safety system for a vehicle, including at least one sensor viewing at least one region in an interior portion of a vehicle defining a protected volume at least partially in front of a vehicle air bag, and logic circuitry responsive to the at least one sensor for determining geometric data of objects in the protected volume ... in accordance with the echoes from the at least one sensor, and inflating the air bag in accordance with the geometric data."	While the invention by US Patent #6,411,202 claims for protection only a subject "...in an interior portion of a vehicle...", the application #10/754,800 claims vice versa - for protection of at least one enclosed portion of a protected area of much bigger dimensions against an ingress or egress intrusion by a subject or trespasser. Therefore, there is the principle difference between said inventions in methods and arrangements of ultrasound intrusion detection, particularly in methods of enlarging the distance of feasible propagation of ultrasound waves.	The method and optional arrangements by US Patent # 6,411,202 both represent the special case for invention by the application #10/754,800 where it regards in particular the enclosed central echelon C.
Patent No. US 5,872,516.	"... discloses a dome-shaped ultrasonic detection area that comprises multiple juxtaposed echelons to detect intrusion into protected area ."	<u>Col.8, Ins 15-26</u> : "A directional, ultrasonic transceiver for pets comprising: an ultrasonic transmitter means for creating an ultrasonic signal within an elongated ultrasonic field envelope, said transmitter means possessing sound shaping means for further augmenting said ultrasonic field envelope to a more beam-like profile; ultrasonic receiver means for wearing by a pet for the detection of said ultrasonic signal within said ... ultrasonic field envelope, ..." <u>Col.10, Ins 51-57</u> : "...said ultrasonic field envelope approximates a beam transmitted along the perimeter of an area to restrict animals to roaming within said perimeter ..."	The ultrasound detection system of the invention by US Patent #5,872,516 is destined to operate in the mode of signal intercommunication with a subject, having been equipped with the ultrasonic transducer, keeping said subject either inside or outside the protected ground-level short-range area restricted peripherally by solid angles of ultrasound beam patterns. Meanwhile, the invention by application #10/754,800 distinctly provides for long-distance detecting of presence or movement of an intruder, which doesn't intent to reveal himself.	The method and arrangements by US Patent # 5,872,516 both represent the special case for invention by the application #10/754,800 where it regards echelon S of the near field zone of intrusion defense.

# Appendix 1

(Continued) Table 2b (E-OfficeAction#1, mailed 07/13/2005)

1	2	3	4	5
<p>Patent Application Publication No: US 2004/0140886 A1.</p> <p>Pub. Date: Jul. 22, 2004.</p>	<p>"... discloses an ultrasonic multi-echelon transmitter that detects objects within a protected area."</p>	<p><u>Claim 1</u>: An apparatus for detecting an object in a cargo trailer comprising: a sensor mounted along a first wall of the trailer, the sensor having a pair of ultrasonic transducers having multiple operation modes with different ranges, with at least one operation mode scanning on area of the cargo trailer adjacent a distal end of the trailer from the first wall on which the sensor is mounted; a trailer tracking control unit connected to the sensor, the control unit controlling the sensor and receiving data from the sensor; and a power source electrically connected to the sensor.</p> <p><u>Claim 28</u>: An apparatus for detecting an object in a cargo trailer comprising: a sensor mounted along a first wall of the cargo trailer, the sensor comprising a first ultrasonic transducer operating in a long range mode that scans out to an area adjacent a second wall, of the trailer, the rear wall being opposite and distal of the first wall, and a second ultrasonic transducer adapted to operate in a short range mode and in a proximity mode, a control module for controlling operation of the sensor; and a power source electrically connected to the sensor and the control module.</p>	<p>According to the invention by the application US 2004/0140886 A1, the enclosed protected area was imaginary partitioned into proximate, short and long range zones where each zone has been being covered by an ultrasound beam pattern either in stationary or in scanning mode. There was not stated any logic intercommunication among those zones. The ultrasound beams are being emitted from and the said reflected beams received by the one-point source having two ultrasonic transducers: the first one for serving the long-range zone, and the second one for serving the proximate and short range zones while being retuned by the control module. So that, there is the evident difference from the invention by application #10/754,800, since there are neither of substantial echelons with the array-type deposition of ultrasound transducers, nor of the information and logic processing interaction among those echelons, see <b>Table 1a</b>.</p>	<p>The method and arrangement disclosed by US Patent # 6,411,202 both represent the special case for invention by the application #10/754,800, since it regards only the enclosed central echelon C.</p>

Notes: 1. The only one phenomenon of ultrasound beam reflection is being used in all the above-mentioned inventions contraposed by the Expertise.

2. The method and arrangement of each of the contraposed inventions evidently differ from the invention by Application #10/754,800.

3. All the above-mentioned contraposed inventions may be added to the listing of references in the Specification of the Application #10/754,800, since it has been composed in compliance with requirements of 37 CFR 1.98 (b).